CHAPTER 4 - DO'S AND DON'TS OF FLOOD PROOFING

Flood proofing is a very viable option to reduce or eliminate flood damages. As discussed in Chapter 1, where flood proofing measures are described and as demonstrated in Chapter 2, where applied flood proofing measures are analyzed, flood proofing can be accomplished by various basic measures and many varying forms of these measures. Successful flood proofing is complex in that many items are involved and all items must function properly. Chapter 2 demonstrates this on a case by case basis. Chapter 2 also demonstrates the converse--unsuccessful flood proofing most often is due to a simple item or two that are either overlooked in the flood proofing measure design or are not designed properly, leading to failure of the item or items and subsequent failure of the entire flood proofing system. Listed below are those items that have been found to be critical to success or failure of the flood proofing measure--the "do's and don'ts" of flood proofing..

1. Do install an internal drainage system as an integral part of any dry, levee, or floodwall flood proofing measure. The drainage system must be adequate to evacuate water accumulated in the protected areas not only from seepage through or under the flood proofing measure but also from rainfall within the protected area. The drainage system must also be large enough to reduce hydrostatic force if dry flood proofing is used to flood proof a basement.

2. Do design floodshields and closures to withstand the same flood-related forces as the basic flood proofing measure.

3. Do remember that flood proofing measures that are barriers (levees, floodwalls, and dry measures) can be overtopped. When this occurs, damages happen that are equal to, if not worse than, those that would occur if the flood proofing measure was not present. A false sense of security can develop. Freeboard should be included as a factor of safety.

4. Do remember that floodshields that span large lengths need lateral bracing, such as diagonal bracing from the top of the floodshield to the floor, to withstand hydrostatic force. All free-standing walls intended to resist hydrostatic force must be reinforced and tied to a proper foundation. All floodshields that span openings 3 feet or greater should be made of metal construction for strength and rigidity.

5. Do design all foundations to be supported to depths greater than any anticipated scour.

6. Do direct sump pump discharge from the protected area well away from the flood proofed structure.

7. Do make certain that all utility entry points through the flood proofing system are properly sealed, and have check valves installed in sewer lines.

8. Don't dry flood proof a structure that has a full basement with nonreinforced walls and floor. If an exception is ever made to this rule, it could only be made if the flood is of very short duration, the soil is not permeable, and the floodwater does not come in contact with the structure. The best alternative is wet flood proofing if sufficient time exists either to flood the basement with clear water prior to the flood or to break up the basement floor and permanently fill the basement with gravel.

9. Do design an internal drainage system using a sump pump with a "backup" power supply consisting of batteries or a generator in case utility electric power fails or is purposely disconnected.

10. Don't use elevation on extended foundation walls in moderate-to high-velocity areas, in areas subject to ice and debris flows, or in areas subject to storm surge.

11. Do remember that structures having full basements with walls designed to resist hydrostatic force must also have the floor reinforced to resist uplift due to hydrostatic force.

12. Don't attempt to dry flood proof basements unless no other alternative exists. Reliable dry flood proofing of basements is extremely difficult to attain due to the hydrostatic force that can cause wall and floor failure or structure buoyancy. If dry flood proofing a basement is employed, be sure to install designer "blowout plugs" that will fail prior to total floor and wall failure or buoyancy.

13. Do remember that the best practice in areas where basements are considered essential is to construct the basements partially above existing grade and then to place fill around the basement walls. This elevates the structure without the visual appearance of elevating, and it lowers the amount of hydrostatic force that can act on the basement walls during flood events. In order to give the highest degree of reliability, the soil surrounding the basement must be highly impermeable and the design flood must not come in contact with the basement walls. Floods of long duration are much more difficult to dry flood proof against than those of short duration.

14. Do place perimeter footings deeper than the expected scour depth around a concrete slab-on-grade to prevent scour beneath the slab and slab failure.

15. Don't enclose lower areas of raised structures with rigid (nonbreakaway) walls in high-velocity areas.

16. Do enclose lower areas of raised structures with "jail-type" flow-through walls in high-

velocity areas.

17. Don't place shallow embedded concrete footings to support elevated structures in coastal areas subject to hurricane forces or in riverine areas subject to high velocities.

18. Don't use metal fasteners to tie structural members together unless they are made of corrosion-resistant material. Protect these fastners from salt water and inspect them annually for corrison where possible.

19. Do always use piles as a foundation in areas subject to erosion and scour.

20. Don't use piers in coastal or riverine areas subject to scour. The footings of this type of foundation are simply too shallow to reliably resist scour.

21. Do develop and maintain a well-vegetated dune system, if possible, to protect from storm surge and scour in coastal areas.

22. Do minimize the amount of obstruction beneath an elevated structure in hurricane and high-velocity riverine areas.

23. Do encapsulate utility duct work beneath elevated structures in plywood to make the duct work less prone to damage from storm surge in hurricane areas.

24. Do remember that in hurricane areas simple things like orienting the floor joists of an elevated structure parallel to the storm surge can prevent damage.

25. Do remember that riprap placed along a beach to provide erosion protection can be removed by hurricane storm surges and driven into coastal structures, creating damage.

26. Do remember in coastal areas to wind proof as well as flood proof a structure.

27. Don't construct levees with sideslopes steeper than 1 vertical to 2 horizontal. A sideslope of 1 vertical to 3 horizontal is preferable.

28. Do relocate from the flood plain whenever possible.

29. Don't remain in a flood proofed structure during a flood event. Staying in a structure to fight the flood results in trading a reduction in flood damages by human intervention with increasing the

potential for loss of life.

30. Do shut off natural gas or propane utilities to a flood proofed structure in preparation for the flood event. Electricity should be shut off if possible if it is not needed to make the flood proofing system functional. Fires do occur in flooded areas because of electrical “shorts” and gas line ruptures.

31. Don’t forget to take into account the structural integrity of the building when considering flood proofing.

32. Don’t forget to take into consideration the size of footings supporting a floodwall and their ability to resist tipping when adding height either permanently to a floodwall or temporarily during a flood fight.

33. Don’t forget to “practice” each flood proofing system that requires human intervention on an annual basis.

34. Do consider establishing a stand of trees and bushes upstream from the flood proofed structures in potential high-velocity areas to shield the structures from high velocities and floating debris.

35. Don’t place flood plain obstructions beneath elevated structures with slabs-on- grade at the upstream edge of the slab in high-velocity areas.

36. Do place concrete around posts used to elevate structures to enhance stability.

37. Don’t construct or flood proof structures in areas that are subject to such extremely high velocities that no feasible structure can survive.

38. Do employ seawalls in coastal areas to protect beachfront property from severe erosion.

39. Don’t construct slab-on-grade floors in coastal or riverine areas where scour beneath the floors is possible without placing perimeter footings to depths greater than potential scour.

40. Do extend piles, piers, posts, and columns from the structural foundation through the floor to the roofline for proper tie-in of the structure to the foundation in coastal areas.

41. Don’t orient the long dimension of a structure perpendicular to floodflows or storm surge.

42. Don’t employ dry flood proofing measures on normally built structures expecting more than

3 feet of water on the walls.

43. Don't use dry flood proofing measures in moderate-to high-velocity areas or in areas subject to ice and debris flow.

44. Do have floodshields for closures readily accessible.

45. Do practice installing floodshields for closures during nonflood periods.

46. Do install a "factor of safety" in those flood proofing measures that can be overtopped.

47. Don't forget to consider the effects of hydrostatic force on basement floors or slabs-on-grade when using dry flood proofing.

48. Don't use a flood proofing measure that requires human intervention in a flash flood area. Always consider the amount of warning time available prior to flooding.

49. Do remember to periodically check the caulking and sealants that make a dry flood proofing measure successful.

50. Do seek professional help from engineers, contractors, and so forth before implementing flood proofing.

51. Don't forget that all flood proofing measures require maintenance after implementation to ensure success.

52. Do purchase flood insurance for flood proofed structures and contents.

53. Do design an anti-buoyancy mechanism to keep a dry flood proofed structure from floating during a flood because of hydrostatic forces.

54. Do compact backfill placed under floodwalls where excavations have been made for utilities to prevent piping.

55. Do design redundancy into a sump pump system so the system can continue to operate without human intervention and without electrical power from a powerline source. Generators or battery backup is required.

56. Do remember that all flood proofing systems are only as good as the weakest part of the system.

57. Do use reinforced concrete in dry flood proofing rather than concrete blocks with steel reinforcement.

58. Do remember that areas subject to ice or debris/mudflows require special flood proofing system designs to withstand forces associated with these hazards.

59. Do install floodshields so hydrostatic force will make the seal tighter. Always install a seal around the edge of the floodshield.

60. Do consider elevating a structure as high as possible to provide the most flood protection. Costs to elevate several feet are normally not much more than elevating one or two feet. The only exception to this are in those cases where wind and/or seismic forces cause costs to increase as structure elevation height becomes greater.

61. Don't use posts or columns that require cross bracing for structure support in areas that are subject to ice or debris and hydrodynamic force.